Sparx Maths

Transition Workbook

GCSE to A-Level

sparxmaths.com

In this booklet, there are a range of questions from key topics that you will have seen in GCSE and will be helpful for AS Level and A-Level.

Each topic has three sections:

- **Introduce** questions allow you to practise the key concepts.
- **Strengthen** questions build on your knowledge of the key concepts.
- **Deepen** questions will challenge your understanding.

Unless otherwise indicated, you may use a calculator.

Use the grid below to keep track of your progress in each topic. Tick the sections you have attempted. If you use Sparx Maths you can find even more questions by searching for the Sparx topic codes in Independent Learning.

	I	S	Sparx topic codes
Indices			U662 U772 U985
Surds	○	○	U499 U707 U281
Expanding brackets	○	○	U768 U606
Factorising quadratics	○	○	U178 U858
Simplifying expressions	○	○	U662 U437
Operations with algebraic fractions	○	○	U685 U457 U824
Solving quadratic equations	○	○	U228 U960 U665 U150
Quadratic graphs	○	○	U589 U769 U601
Straight Line Graphs	○	○	U315 U477 U848 U669 U377 U898
Right-angled trigonometry	○	○	U283 U545 U170

Key facts and formulae:

The Quadratic formula:

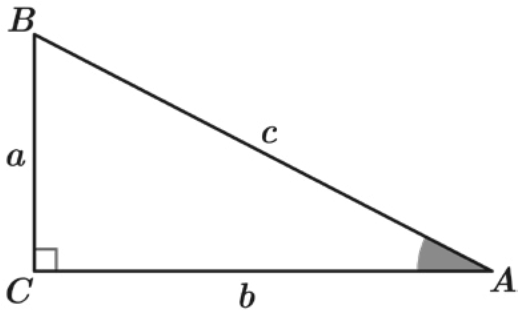
The solution of $ax^2 + bx + c = 0$

where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

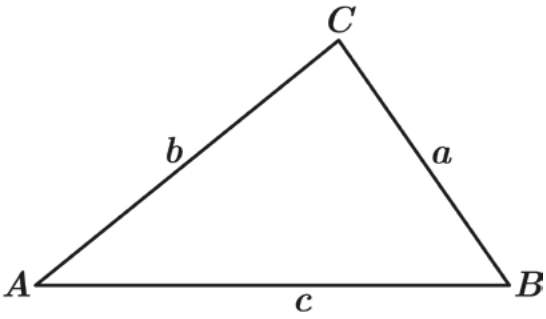
Trigonometry:

In any right-angled triangle ABC where a, b and c are the length of the sides and c is the hypotenuse:



$\sin A = \frac{a}{c}$ $\cos A = \frac{b}{c}$ $\tan A = \frac{a}{b}$

In any triangle ABC where a, b and c are the length of the sides:



sine rule: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

cosine rule: $a^2 = b^2 + c^2 - 2bc\cos A$

Simplifying Algebraic Indices

Write as a single power of x:

(a) $\sqrt{x^3}$ (b) $(\sqrt{x})^3$

(c) $\sqrt[3]{x^2}$ (d) $\sqrt[4]{x}$

(e) $(\sqrt[3]{x})^4$ (f) $\sqrt{x^5}$

Write as a single power of x:

(a) $\frac{1}{\sqrt[3]{x}}$ (b) $\left(\frac{1}{\sqrt[3]{x}}\right)^2$

(c) $\frac{1}{\sqrt{x^3}}$ (d) $\left(\frac{1}{\sqrt{x}}\right)^3$

(e) $\left(\frac{1}{\sqrt[3]{x}}\right)^5$ (f) $\frac{1}{\sqrt[2]{x^7}}$

Write as a single power of x:

(a) $x^2 \times \sqrt{x}$ (b) $\sqrt[3]{x} \times x$

(c) $\frac{x^4}{\sqrt{x}}$ (d) $\frac{\sqrt[3]{x}}{x}$

(e) $\sqrt{\frac{1}{x^5}}$ (f) $\frac{1}{x\sqrt{x}}$

(a) Given that

$$\frac{y^4 \times \sqrt{y}}{\sqrt{y^5}} = y^a$$

find the value of a.

(b) Given that

$$\frac{1}{\sqrt[3]{y^2}} \times \left(y\sqrt{y}\right)^4 = y^b$$

find the value of b.

(c) Given that

$$\left(\sqrt[2]{y^3}\right)^3 \times \frac{1}{y^c} = \left(y^2 \times \sqrt[4]{y^3}\right)^{-2}$$

find the value of c.

Q1 Expand and fully simplify $\sqrt{5}(\sqrt{5}+\sqrt{7})$

Answer: .....

Q2 Rationalise the denominator of $\frac{2\sqrt{5}}{\sqrt{6}}$

Give your answer in its simplest form.

Answer: .....

Q3 Expand and fully simplify $(6+\sqrt{5})(1+\sqrt{5})$

Answer: .....

Q4 Write $(5 + \sqrt{12})(11 + \sqrt{3})$ in the form $a + b\sqrt{3}$, where a and b are integers.

Answer: .....

Q5 Rationalise the denominator of $\frac{1 + \sqrt{2}}{\sqrt{2}}$

Give your answer as a fraction in its simplest form.

Answer: .....

Q1 Expand and fully simplify $(2\sqrt{6} - 5\sqrt{2})^2$

Answer: .....

Q2 Rationalise the denominator of $\dfrac{15 + \sqrt{3}}{10\sqrt{3}}$

Give your answer as a fraction in its simplest form.

Answer: .....

Q3 Rationalise the denominator of $\frac{2\sqrt{7}}{3+\sqrt{7}}$

Give your answer in its simplest form.

Answer: .....

Q4 Write $\sqrt{12} + \frac{33}{\sqrt{3}}$ in the form $r\sqrt{3}$, where r is an integer.

Answer: .....

Q1 Expand and fully simplify $(m + 9)(m + 2)$

Answer: .....

Q2 Expand and fully simplify $(2a + 3)(4a + 5)$

Answer: .....

Q3 Expand and fully simplify $(x - 3)(4x + 9)$

Answer: .....

Q4 Expand and fully simplify $(6n - 5)^2$

Answer: .....

Q1 Expand and fully simplify $2(4d + 5)(3d + 1)$

Answer: .....

Q2 Expand and fully simplify $(x + 1)(x^2 + 3x + 5)$

Answer: .....

Q3 Expand and fully simplify $(3n + 4)(5n + 2) + 5(n + 7)$

Answer: .....

Q4 Expand and fully simplify $(t - 2)(t + 5)(t - 4)$

Answer: .....

Q1 Fully factorise $y^2 + 9y + 20$

Answer: .....

Q2 Fully factorise $x^2 - x - 20$

Answer: .....

Q3 Fully factorise $w^2 - 15w + 54$

Answer: .....

Q1 Fully factorise x^2 - 16

Answer: .....

Q2 Fully factorise $2r^2 + 15r + 7$

Answer: .....

Q3 Fully factorise $5x^2 + 22x + 8$

Answer: .....

Q1 Fully simplify the expression $4y^5 \times 3y^2$

Answer: .....

Q2 Simplify $(h^{-5})^3$

Give your answer without any negative indices.

Answer: .....

Q3 Write $\frac{2t^6u}{8t^3}$ as a fraction in its simplest form.

Answer: .....

Q4 Fully simplify $\left(\frac{t^3}{u^5}\right)^2$

Answer: .....

Q5 Write $\frac{33xy + 9x}{18x}$ as a fraction in its simplest form.

Answer: .....

Q6 Fully simplify $\frac{6a + 42}{a^2 + 11a + 28}$

Answer: .....

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Q1 Write $\frac{(3a)^2}{54ak}$ as a fraction in its simplest form.

Answer: .....

Q2 Fully simplify $(64g^8h^4)^{\frac{1}{2}}$

Answer: .....

Q3 Fully simplify $\frac{x+2}{2x^2-31x-70}$

Answer: .....

Q1 Fully simplify $\frac{14a}{b} \times \frac{b}{2}$

Answer: .....

Q2 Fully simplify $\frac{6a}{v} \div \frac{2a}{5}$

Give your answer as a fraction.

Answer: .....

Q3 Fully simplify the expression below to give a single fraction.

$\frac{n+2}{5} + \frac{6n}{7}$

Answer: .....

Q1

Fully simplify $\frac{2}{5a+4} \times \frac{45a+36}{a}$

Give your answer as a fraction.

Answer: .....

Q2

Fully simplify $\frac{6x}{(5x-7)(x+1)} - \frac{1}{5x-7}$

Give your answer fully factorised.

Answer: .....

Q3 Write the following as a single fraction in its simplest form:

$$\frac{2x^2 - 11x + 12}{x + 5} \div (4x^2 - 6x)$$

Give your answer fully factorised.

Answer: .....

Q4 Fully simplify $\frac{4ab^2}{k} \times \frac{3ak}{12k} \times \frac{7}{5ab}$

Give your answer as a fraction.

Answer: .....

Q1 Find the two solutions to the equation

$(x - 9)(x + 5) = 0$

Answer: .....

Q2 Solve this equation by factorising:

$y^2 + 3y - 10 = 0$

Answer: .....

Q3 Solve this equation by factorising:

$12 - 8w + w^2 = 0$

Answer: .....

Q4 Using the quadratic formula, solve

$4x^2 + 16x + 15 = 0$

Answer: .....

Q5 Solve this equation by factorising:

$2m^2 - 11m + 5 = 0$

Answer: .....

Q1 Using the quadratic formula, solve $y^2 - 6y + 7 = 0$

Give your answer in the form $a \pm \sqrt{b}$

Answer: .....

Q2 Solve the equation below using factorising.

$6y^2 - 11y - 10 = 0$

Answer: .....

Q3 Using the quadratic formula, solve $6x^2 - 35 = -11x$

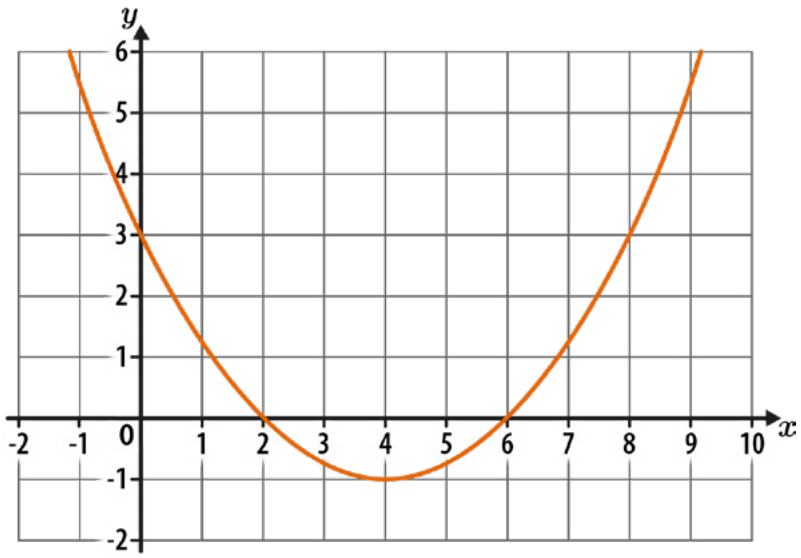
Answer: .....

Q4 Solve $3r(3r - 4) = 2$

Give your answers to 2 d.p.

Answer: .....

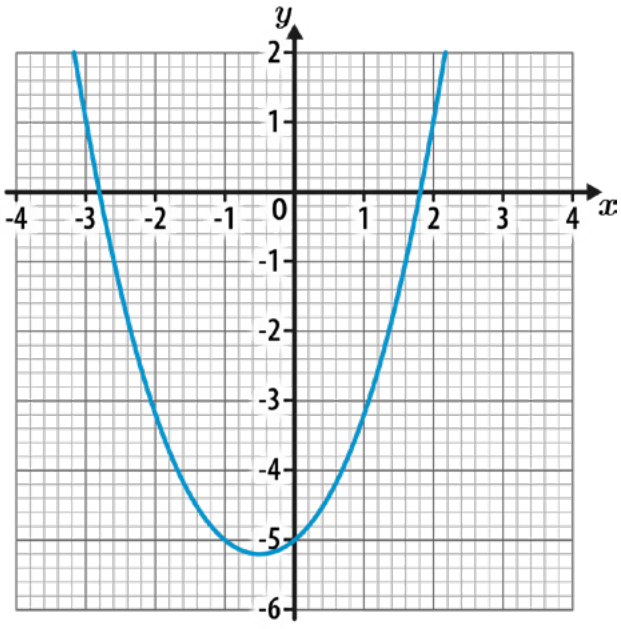
Q1 Write down the coordinates of the roots of the quadratic curve shown below.



Answer: (..... , ...) and (..... , ...)

Q2 Here is the graph of the function $y = x^2 + x - 5$

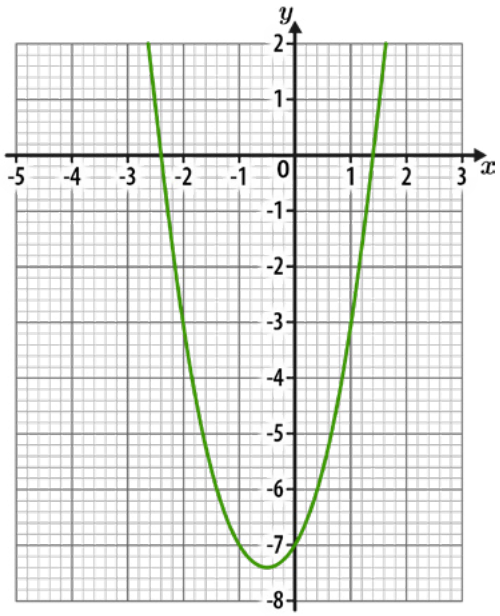
Estimate the solutions to $x^2 + x - 5 = 0$
Give your answers to 1 d.p.



Answer: .....

Q3 The diagram below shows the graph of the function $y = 2x^2 + 2x - 7$

Work out the solutions to $2x^2 + 2x - 7 = -3$



Answer: .....

Q4 a) Write $x^2 + 6x + 11$ in the form $(x + c)^2 + d$, where c and d are numbers.

Answer: a) .....

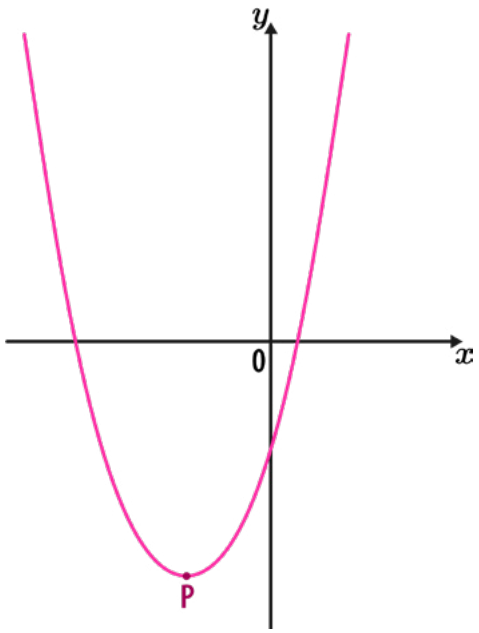
b) Hence, write down the coordinates of the turning point on the curve $y = x^2 + 6x + 11$

Answer: b) (..... , ...)

Q1 The diagram below shows a sketch of the curve $y = x^2 + 8x - 10$

P is the turning point of the curve.

Work out the coordinates of P.



Answer: (..... , ...)

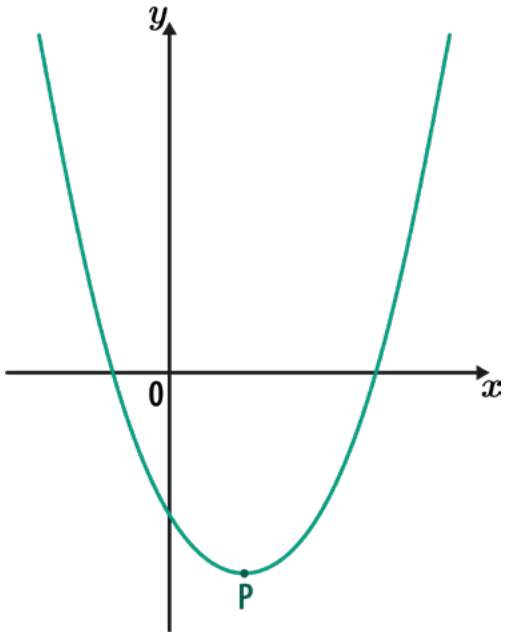
Q2 Work out the coordinates of the turning point of the curve $y = x^2 - 5x + 1$

Answer: (..... , ...)

Q3 The diagram below shows a sketch of the curve $y = 3x^2 - 6x - 10$

P is the turning point of the curve.

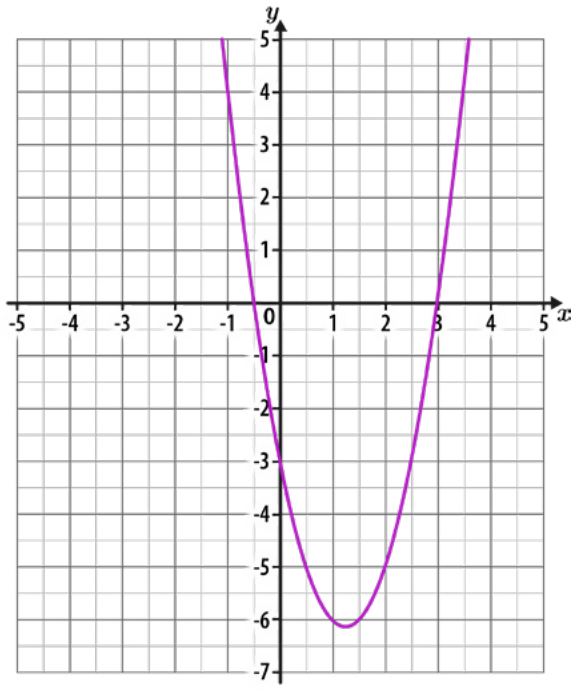
Work out the coordinates of P.



Answer: (..... , ...)

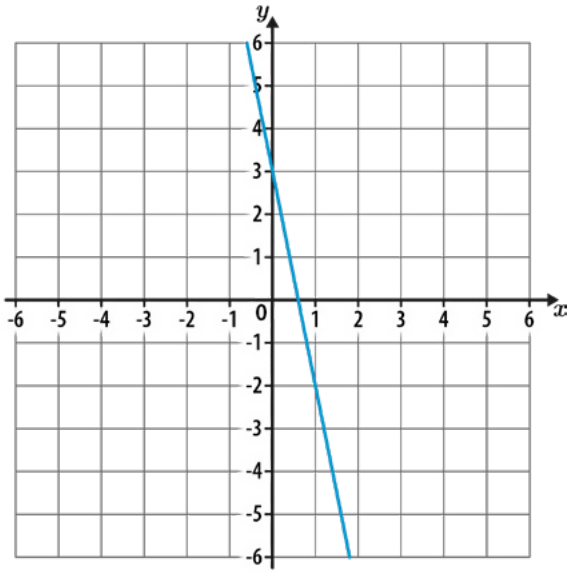
Q4 The diagram below shows the graph of $y = 2x^2 - 5x - 3$

Use the diagram to estimate the solutions to $2x^2 - 5x - 3 = -2x + 2$
Give any decimal answers to 1 d.p.



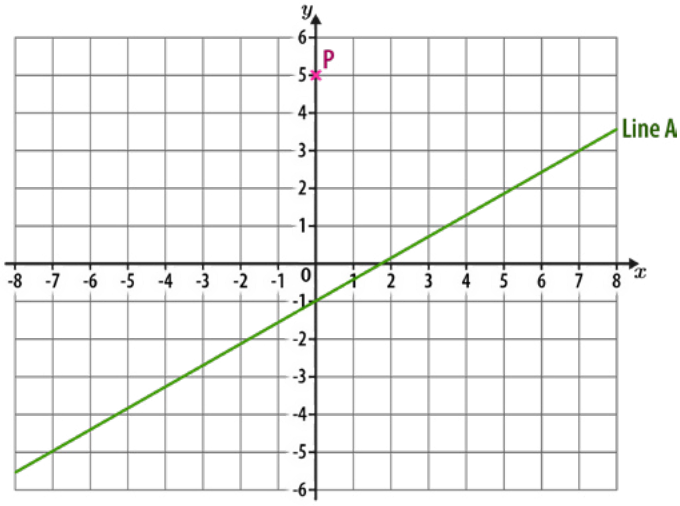
Answer: .....

Q1 Work out the equation of the straight line shown below.



Answer: .....

Q2 Work out the equation of the straight line that is parallel to line A and passes through point P.



Answer: .....

Q3 Line A has the equation $2y - 10 = 16x$
Line B is perpendicular to Line A.

What is the gradient of Line B?

Answer: .....

Q4 A straight line has a gradient of 3 and passes through the point (2, 10)

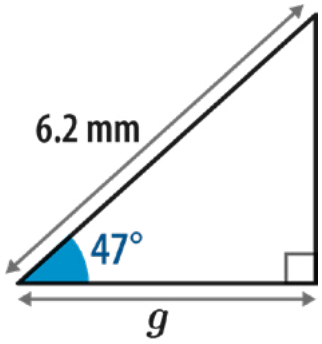
Work out the equation of the line.

Answer: .....

Q5 Work out the equation of the straight line that passes through (2, 3) and (5, 18)

Answer: .....

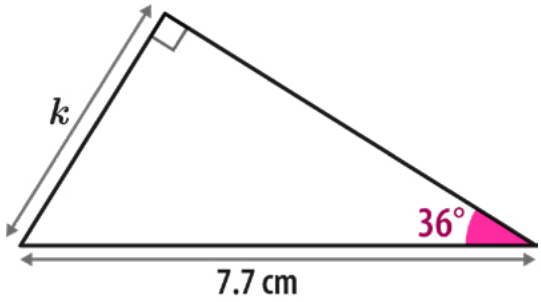
Q1 Work out the length g.
Give your answer to 1 d.p.



Not drawn accurately

Answer: ..... mm

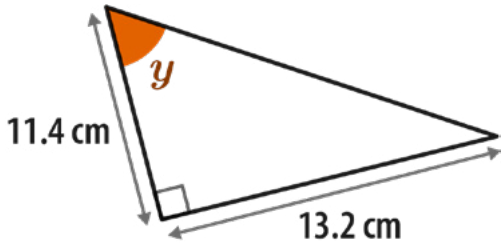
Q2 Work out the length k.
Give your answer to 1 d.p.



Not drawn accurately

Answer: ..... cm

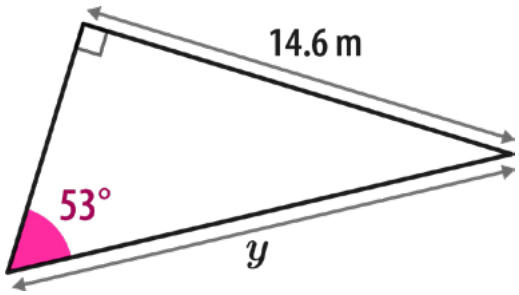
Q3 Calculate the size of angle y.
Give your answer to the nearest integer.



Not drawn accurately

Answer: ..... °

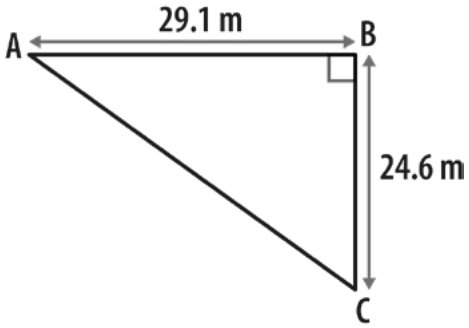
Q1 Calculate the length y.
Give your answer to 2 d.p.



Not drawn accurately

Answer: ..... m

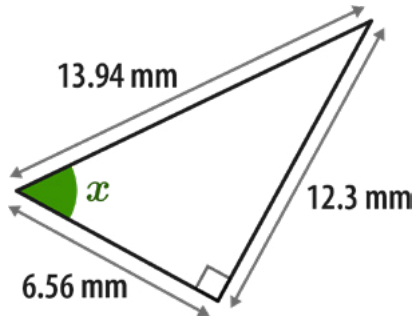
Q2 Calculate the size of angle BAC.
Give your answer to 1 d.p.



Not drawn accurately

Answer: ..... °

Q3 What is the size of angle x?
Give your answer to 1 d.p.



Not drawn accurately

Answer: ..... °